Title

The collaborative study of juvenile rockfish, cabezon, and kelp greenling habitat associations between Morro Bay, California and Newport, Oregon

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California Sea Grant and Pacific Marine Conservation Council
Cooperative Research Project

Collaborative study of juvenile rockfish, cabezon, and kelp greenling habitat associations between Morro Bay, California and Newport, Oregon

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Abstract

There were two primary goals for this project. One was to identify habitat associations of juvenile rockfish, cabezon, and greenling. Our second was to increase our understanding about what is required to develop and implement successful collaborative fisheries research. Juvenile benthic rockfish, *Sebastes* spp., cabezon, *Scorpaenichthys marmoratus*, and kelp greenling, *Hexagrammos decagrammus*, recruits were sampled monthly in untrawlable nearshore habitats between June 2003 and December 2005. Young fishes were trapped with 0.75 x 0.75 x 0.25 m traps of 0.5 inch mesh. Traps were deployed monthly for 24 hours without bait in nearshore (kelp, rock, sand, mud) and bay (eelgrass, mud, sand, pilings, kelp) habitats. This work was conducted with fishermen in Morro Bay, Monterey Bay, Bodega Bay, Fort Bragg, Eureka and Crescent City, California, and Charleston, Port Orford, and Newport, Oregon. Other cooperators include NOAA Fisheries, California Department of Fish and Game, Oregon Department of Fish and Wildlife, South Slough Estuarine Research Reserve. Black rockfish were the most dominant species, accounting for 66% of all rockfish trapped. Copper rockfish were the second most abundant rockfish accounting for 15%.

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2003 – National Sea Grant Fisheries Extension Program
2004 and 2005 - Pacific States Marine Fisheries Commission

Introduction

The goals of this project are:

- Identify habitat associations of juvenile rockfish, cabezon and kelp greenling
- Increase our understanding about collaborative fisheries research

A primary catalyst for this project was lack of information on the habitat usage of the early benthic juvenile life stage of nearshore rockfishes in untrawlable areas. The collaborative aspects of this project started with port meetings with fishermen. The identification of samples sites and habitats was determined through discussions with fishermen. Several trap designs were tested for their durability and effectiveness. The design ultimately chosen for the project was constructed by the fisherman collaborator from Morro Bay, Tom Hafer. Initial samples resulted in expansion of the project to include juvenile cabezon and kelp greenling. Diverse and numerous outreach methods were used to share project results such as port meetings, conference calls, local and national presentations, and newsletter articles.

Methods

Project sampling began in June 2003 and continued through December 2005. Sample sites were located near the ports of Newport, Coos Bay, and Port Orford, Oregon and Crescent City, Humboldt Bay, Fort Bragg, Bodega Bay, Monterey Bay, and Morro Bay, California. Two sites, Coos Bay and Humboldt Bay, include samples taken entirely inside a bay system. Other sites include nearshore habitats and some samples taken in the adjacent bay (Table 1).

Twenty traps were deployed at each port. Habitat types listed below (Table 1) are sampled at depths of 10 to 60 feet. Four or five unbaited traps are set at each habitat type and retrieved 24 hours later. The traps are 24 x 24 x 10 inches, constructed of 16 gauge plastic coated wire of 0.5 inch mesh size (Figure 1). Galvanized rings fasten the door to the trap and will dissolve within a week if a trap is lost. The traps were set without bait. Water quality measurements include salinity and temperature.

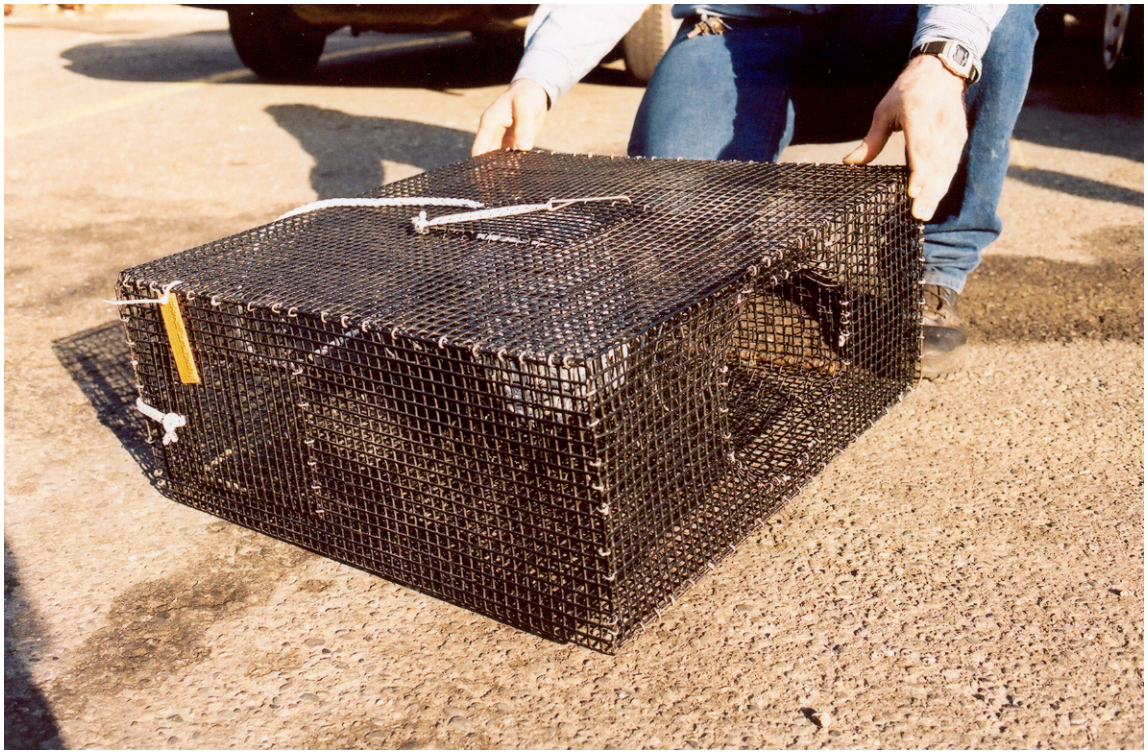

Figure 1. Trap used to sample juvenile nearshore fishes.

Table 1. Habitat types sampled during the study are:

NEARSHORE SITES: *Morro Bay, Monterey, Bodega, Fort Bragg, Crescent City, Port Orford, Newport*	***INSHORE/BAY SITES:*** *Morro Bay, Monterey, Bodega, Humboldt Bay, Crescent City, Coos Bay, Newport*
Habitats Sampled	**Habitats Sampled**
Kelp	Kelp
Rock	Eelgrass
Sand	Pilings
Mud	Mud
	Sand
	Rock

All rockfishes, cabezon, and greenling were measured for total length (TL, ± 1.0 mm) and weighed (± 0.1 gram). The measurements for each fish were recorded with its corresponding date of capture, location, depth, (latitude and longitude), and habitat type. Unknown juvenile rockfish were preserved in 50% isopropyl alcohol for identification in the laboratory.

Results and Discussion

Species Abundance

Cabezon, kelp greenling, and fourteen species of rockfish were trapped during three years of sampling (Table 2). A comprehensive fish species list can be found in Appendix A of this report.

Black rockfish were the most commonly trapped species (n=1198), following by copper (n=274), grass rockfish (n=115) and blue rockfish (n=62). The four most numerous species accounted for 91% of the total rockfish trapped. Black rockfish were trapped in all ports. Copper rockfish were trapped at all ports except Fort Bragg. Grass rockfish were trapped in all ports except Port Orford. Blue rockfish were trapped in Bodega and Monterey. The size range of rockfish trapped was 50 mm – 110 mm TL. (Tables 2 and 3, Figure 2).

The greatest number of cabezon were trapped at Coos Bay (n=120, Figure 3). Cabezon were trapped at all ports in all years. The size range of cabezon trapped was 40 mm – 120 mm TL. (Tables 2 and 3, Figure 3).

The greatest number of kelp greenling were trapped in Monterey (n=83, Figure 4). They were trapped in all ports in all years except for 2003 offshore sites in Crescent City and Newport. The size range of kelp greenling trapped was 90 mm – 220 mm TL. (Tables 2 and 3, Figure 4).

Total number of juvenile rockfish, cabezon and kelp greenling were similar in 2003 and 2005. Approximately twice as many fish were trapped in 2004 in each species group.

Table 2. Total number of juvenile rockfish, cabezon and kelp greenling by year.

Species group	2003	2004	2005
Rockfish	379	978	457
Cabezon	148	273	157
Kelp Greenling	105	207	114

Table 3. Total number of juvenile rockfish, cabezon and kelp greenling trapped at nine ports in California and Oregon between June 2003 and December 2005.

	Newport	Coos Bay	Port Orford	Crescent City	Humboldt Bay	Fort Bragg	Bodega Bay	Monterey	Morro Bay
Black	181	134	223	258	231	27	138	5	1
Black & Yellow	0	0	0	0	0	0	0	28	0
Blue	0	0	0	0	0	0	14	48	0
Bocaccio	0	0	0	0	2	0	0	0	0
Brown	0	0	2	0	2	0	12	0	6
Calico	0	0	0	0	0	0	0	1	0
Chilipepper	0	3	0	0	0	0	0	0	0
Copper	58	6	14	22	21	0	125	26	2
Gopher	0	0	4	1	0	1	4	37	2
Grass	1	1	0	23	15	1	30	9	35
Kelp	0	0	0	0	0	0	8	16	3
Olive	0	0	0	0	0	0	0	3	3
Yellowtail	0	2	2	0	0	0	0	21	0
Vermillion	0	0	0	0	0	1	0	0	1
Cabezon	27	120	112	53	80	57	68	33	28
Kelp Greenling	69	37	75	13	38	38	57	83	16

Low numbers of rockfish were captured at Fort Bragg and Morro Bay. Due to the presence of adults in the commercial fishery we feel more research needs to be done at these port areas to locate early benthic juvenile habitats. Water clarity was a common factor at these two sites. At both sites on numerous occasions, large schools of juvenile rockfish were visible in kelp and rock habitat but did not enter the traps. We observed this on consecutive months in 2004 and 2005.

Monterey was the site with the highest diversity of rockfish species with 10 species trapped. Morro Bay and Bodega Bay had the second highest rockfish species diversity with 8 and 7, respectively. We found 3 to 5 species at the remaining ports. We observed variation in the number of species per port between years and plan to analyze species diversity further. (Figure 2).

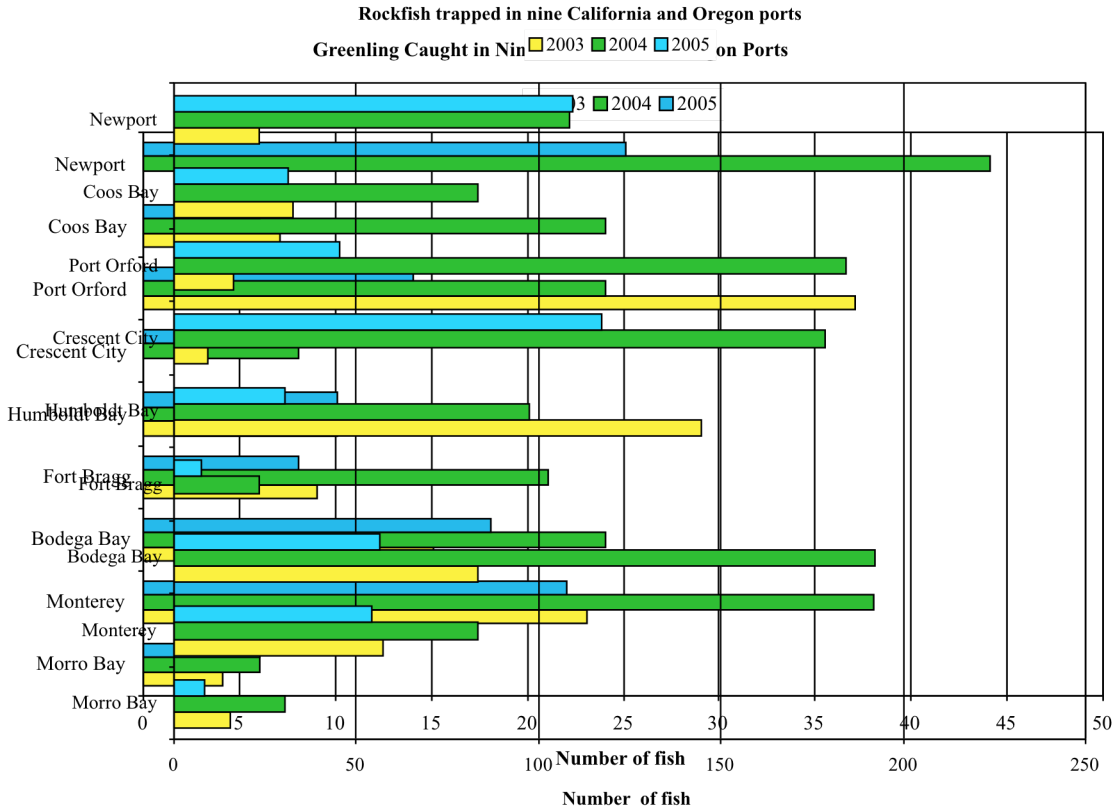

Figure 4. The total number of kelp greenling by port per year

Figure 5. The total number of rockfish of all species trapped at each of nine ports between Newport, Oregon and Morro Bay, California.

The total number of rockfish trapped per year at all nine sites was 379 in 2003, 978 in 2004, and 457 in 2005. In 2003 and 2005 the number of rockfish trapped was similar in all ports except Newport and Humboldt Bay (Figure 1). The greatest number of rockfish were trapped in Bodega Bay (n = 331), followed by Crescent (n=304), Humboldt Bay (n=271), Port Orford (n=245), and Newport, (n = 240). In each of these four ports, one monthly sample in 2004 trapped 50 to 60 young of the year rockfish in one to three traps. The samples with large numbers of rockfish contained newly settled benthic juveniles of approximately 50 mm in total length.

Habitat Association

The six habitat types were described by the benthic substrate where the trap was placed. A subset of habitat types was sampled at each port. Changes were made to sampling sites in 2004 after reviewing the first six months of data. At three ports; Newport, Port Orford and Crescent City, sample sites were moved inshore. At the other six ports the original sites were sampled for three years. In 2004 the original sites were sampled with less effort (less traps) and additional sites were added. In 2005 sample sites were not changed from 2004.

Table 4. The two most highly utilized habitat types by rockfish per port.

Port	**Habitats**		**Note**
Newport	piling	mud	Mud sites were deeper water in channels near eelgrass.
Coos Bay	eelgrass	sand	Sand was associated with drift algae.
Port Orford	kelp	sand	Sand was adjacent to rock reef.
Crescent City	kelp	eelgrass	
Humboldt Bay	mud	piling	Mud site was associated with drift algae.
Fort Bragg	kelp	rock	
Bodega Bay	sand	kelp	Sand was associated with structure, either rock or eelgrass.
Monterey	rock	piling	
Morro Bay	piling	sand	Sand adjacent to boulder reef.
All Ports	**kelp**	**piling**	

Table 5. The two most highly utilized habitats by cabezon.

Port	**Habitats**		**Note**
Newport	piling	mud	Mud sites were deeper water in channels near eelgrass.
Coos Bay	sand	mud	Sand was associated with drift algae.
Port Orford	kelp	sand	Sand associated with rock structure.
Crescent City	sand	piling	Sand associated with rock structure.
Humboldt Bay	piling	eelgrass	
Fort Bragg	kelp	rock	
Bodega Bay	sand	kelp	Sand associated with rock structure.
Monterey	kelp	piling	
Morro Bay	sand	kelp	Sand associated with drift algae.
All Ports	**kelp**	**sand**	

Table 6. The two most highly utilized habitats by kelp greenling.

Port	**Habitats**		**Note**
Newport	piling	mud and sand	Equal numbers were found in mud and sand sites. Over 90% were found at piling sites.
Coos Bay	mud	kelp	
Port Orford	kelp	sand	Sand associated with rock structure. Over 90% found at kelp sites.
Crescent City	piling	kelp	
Humboldt Bay	mud	piling	Mud was associated with drift algae.
Fort Bragg	kelp	rock	
Bodega Bay	kelp	sand	
Monterey	piling	kelp and rock	Equal numbers were found in kelp and rock sites.
Morro Bay	rock		Only trapped in 2003.
All Ports	**kelp**	**piling**	

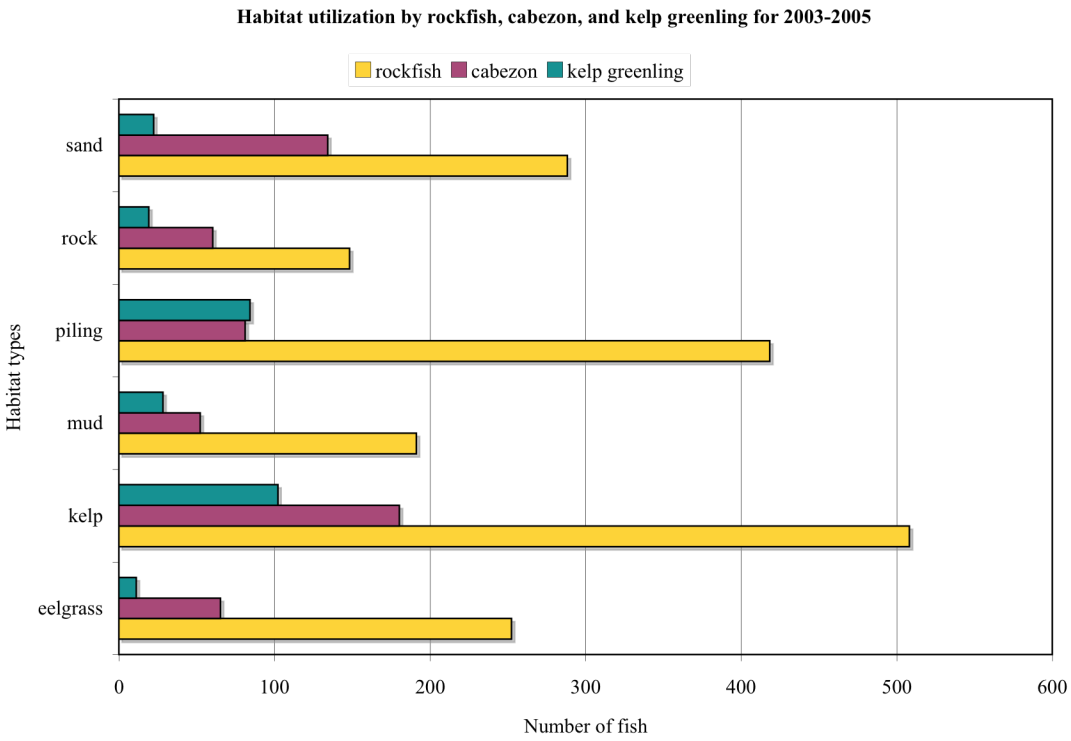

Figure 6. Overall habitat utilization by all species groups 2003 through 2005.

Outreach

Outreach methods included teleconferences, port meetings, newsletter articles, professional conferences, public presentations, and a survey of the project participants.

One of the most important outreach aspects of the project was teleconferences with fishermen collaborators. These were held quarterly to discuss project progress, solicit input on sampling, and for updates on administrative matters. Local knowledge contributed to the sampling design for each port. We are deeply grateful to all the fishermen and other collaborators who contributed information and contacts to make this project possible.

Newsletter articles published by California Sea Grant and the Pacific Marine Conservation Council reached thousands of people throughout the west coast, many of whom contacted us and will receive this report.

An introductory poster about this project was presented at the California and World Ocean ’02 Conference in Santa Barbara, California, October 2002. This presentation facilitated communication with California Department of Fish and Game biologists and managers. We attended several meetings held by CDFG to identify collaborative research topics and to develop implementation methods.

A paper on our first year of results was presented at the Western Groundfish Conference in Victoria, Canada, February 2004. Interest in the project was high with additional collaboration now occurring with Washington Department of Fish and Wildlife biologists. WDFW biologists will be sampling with our traps at habitats identified in this project using their personnel and boats. Sampling will include Puget Sound and outer coast sites. At the American Fisheries Society meeting in 2006, we participated in a poster session for the Collaborative Partnerships Symposium.

Preliminary project results were presented to numerous organizations and students including:

Port Orford Ocean Resources Team
Mariculture Monitoring Committee
Humboldt Bay Interagency Committee
Humboldt State University Fishery classes
High school marine biology classes
University of Washington School of Fisheries
Humboldt Bay Symposia in 2004 and 2005

An evaluation of the human dimensions aspect of this project was completed by F. Conway, Oregon State University, and C. Pomeroy, California Sea Grant, in 2005. The survey was conducted to determine project participants perceptions about the project, their role in it, and its strengths and weaknesses as a joint fishermen/scientist research project

Appendix A. List of fish species trapped at all ports.

Anchovy
Cabezon
Clingfish
Cusk eel
Flounder, starry
Fringehead, onespot
Goby, bay
Goby, blackeye
Greenling, kelp
Greenling, painted
Greenling, rock
Gunnel, kelp
Gunnel, penpoint
Gunnel, saddleback
Halibut, California
Irish lord, brown
Irish lord, red
Kelpfish, giant
Kelpfish, spotted
Lingcod
Midshipman, plain
Pipefish, bay
Poacher, kelp
Poacher, prickle breasted
Rockhead
Rockfish, Black
Rockfish, Black and Yellow
Rockfish, Blue
Rockfish, Bocaccio
Rockfish, Brown
Rockfish, Calico
Rockfish, Chilipepper
Rockfish, Copper
Rockfish, Gopher
Rockfish, Grass
Rockfish, Kelp
Rockfish, Olive
Rockfish, Yellowtail
Rockfish, Vermillion
Ronquil, northern
Sanddab, speckled
Sand lance, Pacific
Sardine
Sculpin, buffalo
Sculpin, bull
Sculpin, fluffy
Sculpin, grunt
Sculpin, padded
Sculpin, rosylip
Sculpin, sailfin
Sculpin, scalyhead
Sculpin, smoothhead
Sculpin, snubnose
Sculpin, staghorn
Smelt, longfin
Smoothhound, brown
Snailfish, showy
Snailfish, tidepool
Sole, Englishg
Stickleback
Surfperch, barred
Surfperch, black
Surfperch, kelp
Surfperch, pile
Surfperch, rainbow
Surfperch, redtail
Surfperch, rubberlip
Surfperch, shiner
Surfperch, silver
Surfperch, striped
Surfperch, walleye
Surfperch, walleye
Surfperch, white
Tomcod, Pacific
Tubesnout
Wolf-eel